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ON INFECTIOUS
PLEURO-PNEUMONIA OF CATTLE.

BY

D. J. HAMILTON, M.B., F.R.C.S.E.,
PROFESSOR OF PATHOLOGY, ABERDEEN UNIVERSITY.

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THE importance of the study of comparative pathology has been forcing itself more and more, of late years, upon the partisans of scientific medicine and of biological science in its wider acceptance. The very close relationship existing between the diseases of the brute creation and those which are human; the danger of their mutual transmission; the utilitarian value of an extended knowledge of the pathology of diseases prevalent among those animals which are subservient to the uses of Man; and, lastly, the fact that diseased processes can be studied so much more thoroughly in the lower as compared with the higher animal, have all contributed to this result.

Pleuro-pneumonia is, pathologically, one of the most interesting diseases of cattle, chiefly on account of its being representative of the great class of zymotic affections—a field of inquiry in which the greatest triumphs of pathology in the immediate future will fall to be recorded. I trust, therefore, that the accompanying remarks may prove interesting and instructive to you, more especially seeing that matters such as this are quite *en rapport* with the broad view you ought to take of the subject upon whose study you are now about to enter.

HISTORICAL.

Contagious or infectious pleuro-pneumonia is more or less prevalent at the present day in all countries. Its earliest history in Great Britain dates back, it is said, only as far as the year 1840; but, no official records were kept of the outbreaks until the year 1869. Previous to the year 1885 it had been steadily decreasing, but, in that year and in 1886, there was a marked augmentation in the number of outbreaks over Scotland, the increase actually being from 55 in 1884, with 321 animals affected, to 324 in 1887, with 1380 attacked; while up to June, 1888, there had been 123 outbreaks, with 493 attacked. The country, however, is not now so thoroughly overrun as in the past year, but the malady is still sufficiently prevalent to dislocate regular traffic in cattle. The epidemic in Scotland during 1887 was chiefly limited to the counties of Lanark, Edinburgh, Fife, Forfar, Perth, Dumbarton, and Inverness. It was, in fact, specially severe among the dairy cattle of large towns, and in those parts of the country into which Irish cattle were directly imported.

PROPAGATION.

There is much want of satisfactory information as to how the disease is propagated; but there seems to be a pretty widespread notion among veterinary practitioners and breeders of stock that it is imported, and is not indigenous, and that it is communicated through the cohabitation of animals. There is doubt as to whether it can be communicated through infected cowsheds: while it seems pretty certain that the poison, whatever it be, which is the exciting agent of the disease, unlike many other animal poisons, soon dies out. The disease can be traced to moving cattle at fairs or markets; and, of late, the diseased stock has been imported almost entirely from Ireland, chiefly from Dublin.

It is most virulent amongst the cowsheds of large centres of population, such as London, Edinburgh, and Dublin, a fact due, probably, to the recognised greater susceptibility of cows yielding milk to its attacks.

PERIOD OF INCUBATION.

The duration of the period of incubation seems to be only approximately known, and a great deal of the evidence on the subject is contradictory or unfounded on experiment. It has been alleged to extend for as long as three months, and it has even been suggested that it may be protracted, in some cases, for more than fifteen months. It seems pretty clear, however, that the lapse of 56 days allowed by the Contagious Diseases (Animals) Act is insufficient to prevent its importation and spread. The disease is difficult of detection in its early stages, and hence may have been running an insidious course for a considerable time before the symptoms become distinctly manifest. Animals from an infected herd may appear healthy enough even when suffering from the disease, a rise in the internal temperature being its only indication.

SYMPTOMS OF THE DISEASE.

The initial symptoms are those of fever, with shivering, loss of appetite, occasionally a dry cough, laboured and sometimes painful breathing, a quick pulse, and a glairy discharge from the eyes and nose. These are followed by dulness on percussing the affected part of the lung, by pain on pressure, and by great prostration. Double pleuro-pneumonia is always more serious than single. The secretion of milk is lessened, but does not entirely fail. The disease terminates in various fashions. A large proportion of the animals, if allowed to live long enough, would eventually succumb to the acute symptoms. In some cases, the affected lung becomes gangrenous, while, in others, the disease lapses into a

chronic state, the animal falling off in flesh, and finally dying with symptoms of pulmonary tuberculosis. In this last respect, the disease differs from pleuro-pneumonia in Man, which, only under the rarest circumstances, shows any tendency to become chronic.

ANIMALS AFFECTED.

It is a disease which apparently affects cattle more than any other class of animals ; indeed, it is questionable whether other animals ever suffer from a disease identical in all its characters with this. Of course pleuro-pneumonia is an affection to which many animals, including Man, are subject, but the extreme infectiosity of this, as compared with pleuro-pneumonia in general, evidently stigmatises it as something specific.

INFECTIOSITY.

The malady is eminently infectious. It has been calculated that where a diseased animal mixes with a herd in the open air, 50 per cent. of the animals contract the disease ; while it is probable that the liability to infection is much greater where the animals are cooped up in cowsheds and dairy byres.

CONDITION OF THE ORGANS.

Of all the organs affected after death, the lung is that in which the gross lesions are most evident. There are the same stages as in the human disease, but, owing to the compulsory slaughter which is now enjoined in all cases so soon as the animal shows symptoms, it is seldom that the later stages are encountered at the present day. The organ becomes congested, at first, and there is evidence of obstructed circulation through it, in the punctiform hæmorrhages into the mucous membrane of the bronchi, beneath the pleura, and

in other localities. Next follows the stage of inflammatory effusion, in which the liquid and solid constituents of the blood are poured out into the cavities of the air-vesicles and into the loose areolar fibrous tissue which separates the lobules. These loose areolar septa are particularly well developed in the ox, and large lymphatic vessels course along them. The liquid part of the exudate is absorbed by these lymphatics, and finds its way into the interstices of the fibrous septa. The fibrin elements contained in it are before long precipitated in the form of a dense and beautifully intricate network of fibrin, entangling a greater or less number of blood elements in its meshes. So abundant is this solid effusion, that these inter-lobular septa increase to three or four times their natural bulk, and hence become very prominent objects. The manner in which they ramify through the lung tissue gives rise to a peculiar marble-like differentiation of the cut surface, the yellow tint of the septa contrasting strongly with the bright red colour of other parts of the lung.

A similar solid inflammatory effusion is found lying within the air vesicles. The fibrin threads of which it is largely composed take hold upon the lung tissue, and are so firmly adherent, that it becomes an impossibility to remove the exudation by expectoration. It must first disintegrate, so as to render it capable of being conveyed away by the pulmonary lymphatics.

If the animal live long enough, it usually happens that the previously solid mass, weighing many pounds, which has penetrated into the minutest air vesicles, liquefies, and is got rid off by the ordinary absorbents. This constitutes the stage of grey hepatisation, as it is called, a stage which is seldom if ever seen in this country, owing to the subject of the disease being slaughtered before it is reached. There is one peculiarity, however, in regard to the affection of the lung as compared with acute croupous pneumonia in Man, namely, that the solid parts are much more irregularly distributed. In the

human subject, the infiltration of an entire lobe is regarded as a typical phenomenon. In this, however, patches here and there of red solidification are met with in the midst of vesicular lung tissue.

The pleura is almost always affected, so much so that the term pleuro-pneumonia has been universally adopted in this country. Its substance is infiltrated with fibrinous exudation, the same as that found in the lung parenchyma, so that it appears to be much thickened, and often measures quarter or half an inch on cross section. The affected part of the pleura is sometimes localised to the seat of infiltration of the lung tissue, other parts of the membrane either escaping entirely, or being affected in a minor degree.

The other organs are comparatively little altered, judging at least from mere naked-eye scrutiny; but, on this point, as upon many others connected with the disease, our knowledge is scanty and unreliable. It would seem, however, that so far as local manifestations of the malady go, the lung is the organ which bears the brunt of the malady. Hence, one is almost led to suppose it is by inhaling the poison that infection is conveyed from one animal to another. Yeo, in his *brochure* on the subject, makes out that the disease commences in the minute bronchi—a view quite in keeping with this mode of contamination. It is by cohabitation that the disease is spread, not, apparently, or only to a subordinate extent, through contact with infected surroundings, and this all the more supports the notion that the virus is conveyed in the breath, and that it is by its alighting on the delicate tissue of the minute bronchi and air sacs that the disease takes root upon a fresh host.

THE NATURE OF THE POISON.

This raises the whole question of what the nature of the poison may be. Presumably, it is a particulate poison of the nature of a vegetable micro-organism—a micro-organism whose habitat is in the system of the cow. Examination of

the affected parts, however, has afforded practically nothing but negative results, or results which, if alleged to be positive, have not stood the test of time. But here, however, as in the case of the majority of other diseases of cattle, little care has been expended on the search for it, and what has been attempted has been gone about in a desultory manner, and not according to the lights of modern bacteriological research. Poels and Nolen allege that they have found Friedländer's coccus of human pneumonia present in abundance. It possesses a capsule, occurs as a mono-, diplo-, or strepto-coccus, and grows in the characteristic nail-like form on nutritive gelatine. It, moreover, reproduces the disease on inoculation. If this and other diseases are capable of being conveyed from one animal to another, then there must be some agent through which the communication is established. What that agent is, and what the agent is which is instrumental in carrying infection in the great class of zymotic diseases of Man and the lower animals, remains as yet in great part unexplained.

IS THE DISEASE PREVENTIBLE?

This brings me, gentlemen, to the practical point of my address—a point to which the preceding remarks merely lead up—namely, the question of whether nothing can be done in this country to stir up the public to realise that this and kindred diseases occurring in animals otherwise sound are at least preventible, and, I will almost venture to think, curable. In the report of the Departmental Committee, recently issued, based upon the evidence of forty-four witnesses, the disease is characterised as incurable, and the only recommendation they can make is to continue the present system of stamping out by compulsory slaughter. This, on the one hand, may be good enough advice as matters stand at present; but, on the other, it constitutes, *ipso facto*, the most bland confession of ignorance and helplessness. The slaughtering of a whole herd of cattle, probably cattle with a pedigree, when one or

more of their number becomes infected, savours more of the work of a nation of savages than of rational and enlightened individuals. I will not go so far as to say that it would be wise to desist from this method of eradication at present. The evidence of those who have to deal with the rearing and keeping of stock seems to be decidedly in favour of it ; and, in concurrence with such valuable practical testimony, it seems likely that this method of treatment will continue until some more feasible means is forthcoming.

SUGGESTIONS FOR PREVENTION.

I venture, however, to suggest—and there is a widespread notion prevalent among intelligent farmers and landed proprietors at the present time in favour of this—that something ought to be done in the way of investigating means of prevention, rather than calmly submitting to this brutal method of destroying the unaffected.

The Highland and Agricultural Society, some time since, instituted an inquiry into the matter, and petitioned the Privy Council for an investigation of the disease. The Scottish Local Authorities also moved in the same direction. And, quite lately, as a result of the deputations sent up by these bodies, Lord Cranbrook appointed a Committee of Inquiry into the nature and extent of pleuro-pneumonia in the United Kingdom. The report of the Departmental Committee charged with this duty, as I before said, has just been issued, and it is in the highest degree melancholy to observe that, as a *dernier ressort*, the only recommendation they have to offer, as being of benefit to the country, is that of compulsory slaughter. The compulsory slaughter clauses of the Order of Council of March, 1888, have as their first provision that—“ A Local Authority shall cause all cattle being, or having been, in the same field, shed, or other place, or in the same herd, or otherwise in contact, with cattle affected with pleuro-pneumonia to be slaughtered within ten days after the fact of

their having been so in contact has been ascertained, or within such further period as the Privy Council may in any case direct”.

Looking at the matter, then, from a scientific point of view, what suggestions may be offered to those interested in the matter as likely to lead to beneficial results? I think that there are several practical points connected with this disease, which even the most callous of our cattle proprietors would not object to know something more about. Let me instance a few of these :

In the first place, there would be manifest advantage in knowing the exact period of incubation, and what circumstances influence it ; as well as how long an animal remains dangerous as a source of infection.

In the second place, the subject of *inoculation* might be put upon a firmer basis. I daresay you are aware that this is a favourite method of preventive treatment. A little of the liquid is pressed out of the lung, and is inoculated on a scratch in some part of the animal's body, usually the tail. The animal does not take ordinary pleuro-pneumonia, but the introduction of the virus is strongly alleged by those who have had much experience of the method to be a preventive. The poison evidently sets up in the animal's system a modified disease, which inhibits the development of the pleuro-pneumonia virus, if not for the remainder of the animal's natural life, at least for a period sufficiently long for the usages of commerce. In a considerable number of cases, however, the animal loses its tail from gangrene. The Belgian Commission, appointed to report on its effects, found that there was a loss from death of the animals of 11·11 per cent. ; in 61·11 per cent. it proved benignant ; and in 27·77 per cent. the tail became gangrenous. The percentage of deaths from inoculation in this country is not large—not more than 4 per cent.—and it is admitted to be an effectual means of reducing the disease to a minimum. In other countries, different views are held as to its efficacy and trustworthiness,

and, in America, feeling runs so high against it, that animals bearing any signs of having been inoculated are excluded from the country.

It is, however, abundantly evident that, in employing inoculation as at present practised, we are working entirely in the dark. We want to be certain—(1) Whether the essential part of the virus is a living micro-organism; (2) what that micro-organism is, and upon what it grows, and whether it germinates rapidly or slowly; (3) whether when cultivated artificially in a state of purity it has a protective influence as a vaccine, and whether the gangrene and blood poisoning which frequently accompany the ordinary procedure of inoculation are due to contamination with other organisms, or are due to a particular condition of the organism itself; (4) whether its virulent properties can be diluted, and still be effectual for inoculation; and (5) whether the liquid in which the organism grows, if purified, has the same protective influence as the organism itself. These are all questions of the deepest scientific interest and practical importance. They are matters about which we know practically nothing; and I think I am perfectly justified in saying that, until we do know something about them, we shall not advance one step beyond the stage in which we are at present.

CATTLE HOSPITALS A NECESSITY.

What steps, therefore, it may be asked, would you recommend in order to attain reliable information on these and other most desirable points? My answer is this:—If the country wishes to know what it is possible to learn in regard to this and allied diseases of the lower animals, they must furnish the means of studying them. To go in a haphazard manner, say, to a farm or dairy to study an outbreak of the disease is perfectly certain to end in failure. What is required is a small cattle hospital, easily got at, with a laboratory and all necessary appliances attached, into which

animals could be brought for the purpose of observation. In Edinburgh and Glasgow there are good enough hospitals for the *treatment* of the diseases of animals. The animals sent into these, however, are not there for the purpose of observation, and no animal would be sent into them if it were thought its recovery would be uncertain or so protracted that it would fail to repay the necessary outlay. A case of infectious pleuro-pneumonia would never be admitted into such at the present day. Now, as regards the investigation of diseases of animals, such as pleuro-pneumonia, it is exactly those animals of least commercial value which would be the most important and instructive as objects of study. In connection with our pathological laboratory here in the University we have all the means at hand for the investigation of a disease of this kind; and I think, on reflection, common sense will declare in favour of seeing at least what can be done to further our knowledge of this scourge of the brute creation.

HOW FUNDS ARE TO BE PROVIDED.

There is only one drawback, namely, the necessary funds. Of course, at first, one naturally turns to Government for aid in a matter of this kind; and if it is to be obtained from this source it would be heartily welcome. My own impression, however, is that our Government will do nothing to favour such a scheme. Measures of this kind generally meet with a cold shoulder in Government quarters. I should be much more hopeful of local efforts. If a few counties, say, in the north of Scotland, agreed to a mere fraction of increase of the rates, a sum would be forthcoming for the purpose. Even in Aberdeenshire alone, taking the valuation at about £900,000, it will be observed that a tax to the extent of an eighth part of a penny would be ample to set such an observatory going, and a fraction of this, yearly, would be sufficient to carry on the Institution. Were a few counties united in

their efforts, the tax would never be felt, and the value of the knowledge to be derived from the inquiry would, I feel persuaded, be ample recompense for the outlay. The amount paid annually out of the rates for compensation in the affected counties must be very large, and will continue to be so as long as cattle are imported from foreign sources. There is every probability that a properly constituted inquiry would reduce this expenditure to a minimum or render it unnecessary.

